

**TRANSPORTATION DECISION MAKING -  
POLICY ARCHITECTURE  
FOR THE 21<sup>ST</sup> CENTURY**

**DRAFT FOR PUBLIC COMMENT**

**U.S. Department of Transportation**

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# **TRANSPORTATION DECISION MAKING - POLICY ARCHITECTURE FOR THE 21<sup>ST</sup> CENTURY**

## **Table of Contents**

### **Chapter One - Introduction**

- Policy Architecture
- The Transportation Enterprise
- Evolution of Federal Policy Development

### **Chapter Two - Decision Making in the Transportation Enterprise**

- Public Sector Decision Making
  - Recent Developments in Transportation Decision Making
    - Urban Decision Making
    - Statewide Decision Making
    - Nationwide Decision Making
- Private Sector Decision Making

### **Chapter Three - Changing Issues and Concerns**

- Introduction
- Economic Changes
- Changing Population and Development Patterns
- Growth in Passenger and Freight Travel
- New Technologies
- Environmental Concerns
- Energy Prices
- Transportation Infrastructure Financing

### **Chapter Four – Decision Making for the Future**

- Factors for Effective Transportation Decision Making
  - Collaborative and Participatory
  - Balanced
  - Multimodal
  - Flexible and Rapid
  - Informed
  - Innovative
  - Financially Sound
  - Workforce Effectiveness

## **Chapter Five – Strategies to Support A Changing Enterprise**

- Strategies to Foster Participation and Collaboration
- Strategies to Foster A Balanced Approach
- Strategies to Foster Multimodalism
- Strategies To Support More Flexible and Rapid Decision Making
- Strategies to Support Informed Decision making
- Strategies to Foster Innovation
- Strategies to Foster Sound Financing
- Strategies to Foster An Effective Workforce

## **Chapter Six – Strategies for U.S. Department of Transportation**

## **Chapter Seven – Conclusions**

### **Accomplishment Boxes**

- ISTEA/TEA-21
- Marine Transportation System
- Open Skies
- Transportation Infrastructure Finance and Innovation Act
- Safety
- AIR-21
- Intelligent Transportation Systems
- Project America
- Garrett A. Morgan Technology and Transportation Futures Program

## **Transportation Technologies for the Future**

- Information Technologies in Future Transportation
- Improving Transportation Efficiency With GPS
- Partnerships for a Cleaner Environment
- E-Commerce and Transportation
- Virtual Manufacturing of Future Air Transports
- Microengineering Powers
- Nanotechnology Affects Transportation

# CHAPTER ONE

## INTRODUCTION

*“And I submit that as we live in times of change, we must be architects of that change or we will most certainly be its victims.”*

John A Volpe, speech to the Western Association of State Highway Officials, Salt Lake City, Utah, June 6, 1972

Transportation policymakers live in a world of change so rapid and profound that the lines between forecast and reality frequently blur. In 1903, few envisioned that the Wright Brothers’ short flight on the dunes of Kitty Hawk, North Carolina, would lead to transatlantic passenger service just 33 years later, and to man’s first steps on the moon, just 36 years after that. As technology continues to renew and expand, transportation must and will change too, as new forces stretch the human mind and open our futures to new opportunities as yet undreamed.

At this threshold of a new century and a new millennium, the process of globalization has broadened our horizons and forever changed the way we grow, develop, communicate, learn and care for our planet and for each other. As it has changed individual lives, it has also influenced government to streamline programs, encourage privatization of many functions and responsibilities, and recognize that problems are best addressed through inter-jurisdictional and inter-institutional collaboration, public involvement, and holistic approaches.

Globalization’s change has created tensions as well, as it clashes with local customs, priorities, and needs. The new forces that globalization has unleashed confront the international community with challenges and opportunities that fundamentally affect the way government, together with its myriad of stakeholders, makes judgments and decisions about the future. For transportation, this new world of change demands a new way of thinking about transportation’s place and contribution to the larger purposes it serves. It demands new tools, new alliances, and a new architecture for determining the intricate choices that transportation entails and creates.

### **Policy Architecture**

These changes present opportunities in transportation policy and decision making . The purpose of this report is to describe the issues that affect decision making and discuss a framework for future decision making -- a *policy architecture* -- that can prepare the transportation system to respond effectively to issues and challenges.

Just as in any large organization today, future transportation decision-makers will need to consider how we efficiently organize and manage our work - our *business affairs*; how we make multimodal, technological, and infrastructure investment decisions for the national transportation system - our *development affairs*; and how we identify

opportunities to foster a climate for transportation innovation and continuous learning - our ability to create *learning organizations*. These three overarching questions collectively provide an umbrella framework for addressing future transportation decision making in this report.

*If you don't feel the need to have all of the power in your hands, and you see your ability to persuade as an ability to influence, then you can work with the entire stakeholder community.*  
Secretary Rodney Slater, DOT Policy Architecture Forum

Future decisions of all stakeholders of the national transportation system will require a collective visionary and vigilant leadership throughout the transportation enterprise. The U.S. Department of Transportation's (DOT's) primary role is exercising strong leadership in addressing the emerging issues and future challenges facing transportation and providing effective stewardship over the existing transportation system. This report establishes a framework for making decisions specifically aimed at future outcomes to and impacts on the U.S. transportation system in 2025.

The decision making roles of public- and private-sectors defined in Chapter Two and the emerging issues and concerns addressed in Chapter Three set the stage for the policy architecture discussion. Chapter Four defines the critical factors for a transportation decision making process for the future. Specific strategies presented in Chapter Five present a variety of approaches that can be considered to move towards more effective transportation decision making. The Department gathered these strategies from stakeholders through extensive outreach over the first six months of the year 2000.

A companion report, *Transportation in the Next Millennium*, provides greater detail on the history of issues facing transportation during the last quarter of the 20<sup>th</sup> Century and leading into the 21<sup>st</sup> Century. Taken together, these two documents provide information and points of departure for future decision makers in the transportation enterprise.

### **The Transportation Enterprise**

This report addresses America's *transportation enterprise* which is comprised of all the parties involved with the investment, management, operations, and uses of transportation. These public and private interests with multiple goals make up the transportation enterprise. No single organization within it has direct responsibility for the whole, or even a majority of the enterprise. Individual entities make decisions according to their needs and resources, and the aggregate of these decisions may not be optimal for the overall enterprise or may have unintended consequences for the whole enterprise. For example, individuals who drive to work alone worry little about insufficient non-auto choices. Those looking at the system from a national perspective, however, may be concerned about limited choices and the resultant extreme demands on one segment of the transportation system.

Each entity has its own role in the enterprise. For example, individual companies decide

which markets to serve in what manner. Congress decides how much federal money will go to individual modes of transportation across the country. Local and state governments decide on modal funding as well as what infrastructure to build to solve a particular set of problems or to serve specific needs. The Department has the role as steward of the transportation system, providing leadership and helping to set the conditions within which individual participants make effective decisions.

### **Evolution of Federal Policy Development**

Transportation policy development in the United States has evolved in response to national problems and opportunities, shifts in ideology on the role of government, and changes in the nation's transportation systems, networks, and technology.

President John F. Kennedy described the American approach to transportation as “(a) chaotic patchwork of inconsistent and often obsolete legislation and regulation.”

President Lyndon B. Johnson wrote that “(t)he country's transportation facilities respond to the needs of an earlier America” and asked the Congress to establish the U.S.

Department of Transportation (DOT) to create a “coordinated transportation system.”

#### **Formation of DOT**

The U.S. Department of Transportation Act of 1966 tied the creation of the Department to the economic growth and stability of the Nation. The U.S. DOT was established in 1968 to:

- assure the coordinated, effective administration of the federal government's transportation programs;
- facilitate the development and improvement of coordinated transportation service, to be provided by private enterprise to the maximum extent feasible;
- encourage the cooperation of Federal, State, and local governments, carriers, labor, and other interested parties toward the achievement of national transportation objectives;
- stimulate technological advances in transportation;
- provide general leadership in the identification of transportation problems; and
- develop and recommend to the President and the Congress for approval national transportation policies and programs to accomplish these objectives with full and appropriate consideration of the needs of the public, users, carriers, industry, labor and the national defense.

Many DOT programs originated in other Executive cabinet departments. The highway grant programs, for example, originated as Department of Agriculture programs to improve access for farmers to markets in urban areas. The aviation programs were started to nurture and ensure the safety of the new mode. Maritime programs were created to enforce revenue laws during the 18<sup>th</sup> century. The Department of Transportation was created to bring order and cohesion to these policies and agencies and to move towards a more comprehensive and coordinated transportation decision making process.

Periodically, DOT has reflected on the status of the transportation system to assess whether or not the transportation system is prepared to meet emerging challenges and opportunities. Since 1968, the Department has undertaken six such major, comprehensive, intermodal assessments. Other independent commissions have prepared additional system-wide reports. A common theme in these reports is the desirability of greater coordination among programs and the need to bring a more intermodal, or multimodal, perspective to transportation policies and programs.

One of the more comprehensive studies was *National Transportation Trends and Choices* released in 1977 by Secretary William T. Coleman Jr. *Trends and Choices* was prepared during a period of major energy shortages, high inflation, slow growth and extensive economic regulation of transportation operations. The report emphasized the importance of: (1) comprehensive transportation policy, (2) competition among transportation modes, and (3) the role of the U.S. Department of Transportation in making program and resource allocation decisions in light of intermodal tradeoffs and broader national objectives.

### **National Multimodal Transportation Studies prepared by Department of Transportation**

1972 National Transportation Study – 1972	John A. Volpe
1975 National Transportation Study – 1974	Claude S. Brinegar
1977 National Transportation Trends & Choices	William T. Coleman, Jr.
1980 National Energy Transportation Study	Neil Goldschmidt (DOT) and Charles Duncan, Jr (DOE)
1990 National Transportation Strategic Planning Study	Samuel K. Skinner
1996 A Progress Report on the National Transportation System Initiative	Federico F. Peña

### **Other National Multimodal Transportation Studies**

1988 Fragile Foundations: Report on America's Public Works	National Council on Public Works Improvement
1979 National Transportation Policies Through the Year 2000	National Transportation Policy Study Commission
1985 Freight Transportation	Eno Foundation
1991 Delivering the Goods: Public Works Technologies, Management and Financing	Office of Technology Assessment
1994 Toward a National Intermodal Transportation System	National Commission on Intermodal Transportation

The world has changed greatly in many ways since then. The nation is in a period of globalization and economic growth with relatively low inflation and rapid technological transformation. In the face of such changes and at this beginning of a new millennium, DOT needs to again answer the question that President Johnson asked over 30 years ago:

***Is the transportation system capable of meeting the future needs of the nation?***

Over the past three years, the U.S. DOT has put into place internal systems and processes to address the nation's future transportation needs. There are several interrelated internal planning activities and tools to guide Departmental actions.

- The Department's strategic planning process resulted in broad organizational goals, outlined major strategies for DOT to undertake to achieve those goals, and set a framework for performance goals to measure progress. The first Strategic Plan, issued in 1997, had a five-year time horizon and was updated in 2000. The first plan was judged by the Congress as the best in the federal government.
- The Department's Performance Plan, with a one-year time horizon, describes specific initiatives to be undertaken to implement the Strategic Plan and provides quantitative measures of annual changes in the performance of the transportation sector. The Performance Plan, in turn, is monitored through agency and senior executive Performance Agreements that are updated each year.
- The Department instituted a "ONE DOT" approach to bring a unified, multimodal approach to problems and programs. ONE DOT activities occur in those areas where the unique mandates, expertise and responsibilities of the individual operating administrations overlap. ONE DOT also provides a viewpoint across all modes and programs and is directed toward better program resource management.
- Within the ONE DOT framework, the Department has instituted "Flagship Initiatives" to highlight priority areas where the Department is pursuing specific shorter-term accomplishments. Under this process, ONE DOT committees identify and implement specific program goals building on Departmental activities.

The policy architecture outlined in this report is proposed as a next logical step for the Department of Transportation to lead the changes encompassing transportation on a global scale. It is envisioned as the over-arching framework that supports effective decision making for today's very complex transportation industry, relates DOT internal activities with external actions by stakeholders in the transportation enterprise, and offers strategies to guide future decision making in transportation.



## **CHAPTER TWO**

### **DECISION MAKING IN THE TRANSPORTATION ENTERPRISE**

The transportation enterprise's operations and services are established by individual decisions made by its many members. Each entity, whether public or private, makes decisions that seek to achieve specific goals: private companies seek maximization of profits and shareholder value while public agencies seek to ensure a balanced system transportation system that achieves social goals including safety, accessibility, environmental protection and national defense. The aggregate of and synergy among these individual decisions determines the total services and structure of the transportation enterprise.

#### **Public Sector Decision Making**

The public sector identifies the circumstances in which markets can be relied on to achieve efficiency, those in which equity demands intervention, and those in which a balance must be struck between efficiency and other important social goals. These identifications and interventions are made according to formal procedures that govern budget allocations, investment and operations, decision schedules, and public involvement. The procedures, created by legislation and regulation, are intended to establish transparency and accountability in Federal, state and local agencies. The private sector pursues efficiency within the resulting sphere that is a blend of private and public values, objectives, and purposes.

Because of the high initial investment needed to incubate a mode, each major transportation mode—highways, waterways, rail, transit, and aviation-- received support from legislative and executive bodies when its potential public good became apparent. As the mode matured, the public sector modified its support to allow the private sector's pursuit of increasing efficiencies within the modal market. As a result of this legacy and its subsequent adjustments, public sector decision making has traditionally been separated by mode and limited private operations to individual modes. The public sector's evolution from incubator to facilitator has been accompanied by a broadening of decision making process, allowing an increasingly multimodal approach for public and private operators.

The Transportation Equity Act for the 21<sup>st</sup> Century of 1998 (TEA-21), the successor to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), provided the funds and legislative mandates for the next six years of surface transportation investment. The Department of Transportation conducted a multimodal, participatory dialogue through five national listening sessions and five One-DOT conferences before initiating the regulatory process to implement this landmark legislation.

State and local governments own the preponderance of public sector transportation facilities and services, and the aggregation of their regional decisions determines the public component of how the national transportation system operates. The federal government provides the national policy framework, financial aid, technical assistance, training, data, and research in support of state and local decision making. Consequently, the efficiency and effectiveness of the national transportation system is the cumulative result of discrete decisions by individual public and private entities.

### **Recent Developments in Public Decision Making**

Changing issues, conditions and values drive the parameters of transportation decision making. The current system is the legacy of incremental adjustments made over decades of transportation policy. In recent years, when the opportunity to address the basic constructs of the decision making system arose, the enterprise significantly strengthened basic decision making processes.

**Urban Decision Making.** During the 1960s and 1970s, the nation began to recognize the regional scope of metropolitan transportation decisions. The Federal-Aid Highway Act of 1962 required urbanized areas of 50,000 or more population to develop a continuing, comprehensive urban transportation planning process, carried out cooperatively by states and local governments, as a condition of eligibility for federal-aid highway funds.

The Act influenced the organization of urban transportation decision making through three key provisions. It:

1. Structured the planning and decision making processes at the regional scale for an entire urbanized area and not for individual governmental units,
2. Required states and local communities to undertake cooperative planning processes, and
3. Required the coordination of urban transportation systems with land development on a multimodal basis.

The Airport and Airways Development Act of 1970 established the Aviation Trust Fund. As part of this increased Federal role, formal guidance on airport planning was initiated through such publications as the Advisory Circular on Airport Master Plans. The first Metropolitan Airport System Plan studies were undertaken at this time.

The Federal-Aid Highway Act of 1973 strengthened planning requirements by establishing Metropolitan Planning Organizations (MPOs) in urbanized areas of 50,000 or more in population. Composed of local elected officials and designated by state governors, MPOs assumed responsibility for urban transportation planning and decision making processes and were charged with developing long-range plans and shorter range transportation improvement programs for their region.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) required MPOs to establish an inclusive, proactive public involvement process for community participation

and to coordinate transportation plans with the provisions of the Clean Air Act. The Transportation Equity Act of the 21st Century (TEA-21) built on ISTEA's inclusiveness by requiring participation by "citizens, affected public agencies, representatives of transportation agency employees, freight shippers, private providers of transportation, representatives of users of public transit, providers of freight transportation services, and other interested parties."

As the urban planning and decision making process evolved towards an increasingly inclusive process, federal legislation has increasingly provided funding flexibility among program categories allowing transportation investments to better respond to locally-determined needs and priorities. A clear example of moving toward increased local decisions is illustrated by the gradual acceptance of airport project financing by means of direct passenger charges. The Anti Head Tax of 1973 outlawed passenger taxes if an airport receives federal funds. This prohibition was modified in 1990 to allow limited and constrained Passenger Facility Charges for projects that improve aviation system capacity. The maximum fee has recently been raised as part of AIR-21. In 1994 Congress added to the strictures placed on airport operators which prevented the use of airport funds for non-aviation purposes.

**State and Regional Decision Making.** ISTEA extended the urban process requirements to statewide planning. The Department issued regulations requiring a statewide transportation planning process as a condition for receiving federal surface transportation financial assistance. States had to develop a long-range plan and a shorter term statewide transportation improvement program, ensuring that transportation planning included rural areas and was coordinated across the state. TEA-21 extended these provisions by requiring the statewide planning process to include local elected officials.

Congress has also gradually expanded the number of states administering state block grants under the Airport Improvement Program from an initial three in 1990 to ten by 2002.

DOT and EPA frequently respond to requests for assistance from localities by sharing information from other regions of the country or by providing directed assistance to regional decision making processes. When multiple jurisdictions face decision difficulties as a result of competing agendas, DOT helps convene and facilitate discussion among the involved parties.

In many regions, regional harbor committees consisting of ship operators, port and terminal operators and the various state, local and federal agencies with responsibilities for marine transportation have been formed to address issues of common concern. While most of these were originally formed for safety and environmental protection purposes, their mandate has been greatly expanded to discuss and reach consensus on a wide range of port and marine transportation planning, development and oversight issues.

**National Decision Making.** National decision making, in general, influences resources and processes of local decision making and determines conditions under which the

federal government becomes an active partner in operating or building a component of the transportation system. Legislation, authored by Congressional subcommittees, which is frequently modally and project specific, provides the authority and funding for national decisions. The U.S. Department of Transportation, working with other federal agencies, operates within its legislative authorization to provide resources for maintenance and expansion of the nation's transportation networks; provide information through technical assistance, facilitation, experimentation, and research; ensure that national goals of safety, environmental protection, economic development, and national defense are met; act as an advocate for U.S. transportation; and increase the market's role through deregulation.

Federal support of experimental transportation decisions – such as innovative finance and congestion pricing experiments – expands options for other members of the enterprise. Research supported by DOT, Environmental Protection Agency (EPA), the Department of Energy (DOE) and others helps document successful decision making processes and supports technological innovation.

The investment decisions of DOT and the Department of Defense determine the operating conditions of the national air traffic control system, the ports, and the waterways. Environmental impact regulations developed by DOT and EPA minimize transportation's impact on air and water quality through the local and state transportation plans. Investigations by the National Transportation Safety Board document incidents that compromise safety and result in recommendations to improve safety procedures and rules.

DOT and the Department of State act as advocates for U.S. transportation interests in the global transportation system. International trade agreements expand the horizons of the U.S. transportation industry and provide better service to consumers while raising safety and competitive challenges.

DOT receives input, advice and recommendations on its work from individuals and the private sector using a wide variety of methods. The regulatory process entails a substantial, formalized process of comment and review from the public. There are also a significant number of formally chartered advisory councils such as the RTCA, ITS America, and the Marine Advisory Council. Air-21 establishes an expanded Aviation Management Advisory Council that has responsibility for overseeing the administration, management, conduct, direction, and supervision of the air traffic control system. DOT also seeks the views and share knowledge with individuals, companies, and trade associations through non-formal processes.

### **Private Sector Decision making**

Transportation was economically regulated in the past to ensure equity of access and mobility using control of entry and exit, rates and earnings, and conditions of service. Over the past 25 years, national transportation policy has changed to favor competition over regulation. In each of the past three decades, bipartisan majorities have approved

deregulation legislation. Federal economic regulation has increasingly been reserved for major market failures or broader social purposes. Most recently Congress, as part of AIR-21, required the gradual elimination of operational slots at New York's LaGuardia and JFK airports and Chicago O'Hare. Congress has also mandated that airports where the majority of passengers are served by just one or two carriers must develop and file competition plans with DOT prior to applying for the expanded passenger facility charge. In the sphere of project financing for air traffic modernization AIR-21 now permits up to ten projects to be funded through a demonstration matching program that expands the sources of non-Federal funds to both airport sponsors or joint ventures between an airport and one or more carriers while limiting the federal contribution size and match. The principal rationale for the limited remaining regulatory structure is to protect competition and the interests of consumers.

As a result of national regulatory reform on air and surface transportation, distinctions among service providers -- airlines, motor carriers, package express carriers, air and surface freight forwarders, and agents-- have blurred for transportation users. Single service providers can now hold different responsibilities on different segments of a trip.

In general, private sector companies seek to maximize profits through their individual decisions about investment and operations. They compete in the partially regulated marketplace, both domestically and internationally, with producers of similar products and services who must meet similar standards of public health and safety, environmental quality, and competitive practices.

The FAA as a modal regulatory agency is in the process of reengineering its and the private operators respective roles. Air traffic management is shifting from a centralized command and control hierarchy to a more demand responsive and collaborative service model. One example of this approach has been the testing and subsequent national implementation of Collaborative Decision Making (CDM) which enables private sector firms to make individual scheduling decisions that affect their services and passengers. Conceived in the mid-1990s the approach incorporates both new operational procedures and decision support tools for managing the ground delay programs implemented by the FAA to minimize inflight delays. The prototype operations were initiated in January 1998 at two major hubs. After a successful period of testing and evaluation the system was implemented nationally in September 1998. Airlines confer four times a day with the FAA in order to set and adjust their schedules to reflect the latest information. Under CDM the FAA sets targets based on the latest weather data, shares this information with air carriers who each decide how to best deal with the expected constraints.

The *providers*--airline, trucking, bus and shipping companies--decide, on the basis of expected market returns, on the services, routes, prices, and quality of service to produce. The *users*--individuals and companies--decide which carrier and services to purchase from competing producers. The available choices and decisions are constrained by the geographic distribution of homes and business, which influence the available transportation facilities and services for the users' demand.



Legislation	Impact on Decision making
<p>Deregulation:</p> <p>1976--Railroad Revitalization and Regulatory Reform Act of 1976 (4-R Act)</p> <p>1977--Air Cargo Deregulation</p> <p>1978--Airline Deregulation Act of 1978</p> <p>1980--Motor Carrier Act of 1980</p> <p>--Staggers Rail Act of 1980</p> <p>--Household Goods Transportation Act of 1980</p> <p>1982--Bus Regulatory Reform Act of 1982</p> <p>1984--Shipping Act of 1984</p> <p>1986--Surface Freight Forwarders Deregulation Act of 1986</p> <p>1994--Trucking Industry Regulatory Reform Act of 1994</p> <p>--Federal Aviation Administration Authorization Act of 1994</p> <p>1995--Interstate Commerce Commission Termination Act of 1995</p> <p>1998--The Ocean Shipping Reform Act of 1998</p>	<p>Bipartisan legislation enacted in each of the past three decades codified a new regulatory principle that competition is the best regulator of transportation. Federal economic regulation has increasingly been reserved for major market failures or as a tool to pursue broader social purposes.</p> <p>Consequently, the decision making process covering entry, exit, control, pricing, and quality of service has been relinquished by the federal government and turned over to the carriers and their customers.</p> <p>In return for economic freedom, the federal government has more stringently enforced safety standards.</p>
<p>Reauthorization:</p> <p>1991--Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)</p> <p>1998--Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21)</p> <p>2000 – Aviation Investment &amp; Reform Act for the 21<sup>st</sup> Century (AIR-21)</p>	<p>ISTEA provided an investment framework where the federal government works with state and local government through stronger planning requirements, and unprecedented flexibility to state and local officials to help assure that transportation investments meet the needs of particular communities. TEA-21 continues and strengthens the proven strategies of ISTEA.</p> <p>AIR-21 provides a 3-year authorization for the FAA to increase aviation system investment to \$40 billion with emphasis on modernization of air traffic system management and airport construction projects.</p>

## **CHAPTER THREE**

### **CHANGING ISSUES AND CONCERNS**

#### **Introduction**

In the 2025 visioning sessions that were held to gather stakeholder views, hundreds of individuals from industry, academia, government, and other groups discussed the issues they believed were most likely to influence transportation over the next 25 years. The factors most often mentioned were:

- Globalization and Other Economic Changes,
- Changing Population and Development Patterns,
- Growth in Passenger and Freight Travel,
- New Technologies,
- Environmental Concerns,
- Energy Prices, and
- Transportation Infrastructure Financing.

These are the major societal issues that seem likely form the background for transportation decision making for the foreseeable future.

#### **Economic Changes**

In 1975, the base year for the data in Trends & Choices, the nation was just emerging from a recession. The country suffered three additional recessions after that: in 1979, 1981-1982, and 1990. The U.S. economy has grown unabated since 1991, providing the longest economic expansion in U.S. history in February, 2000 – 107 months without recession. Economic globalization has become the dominant force in the world economy. U.S. exports and imports grew from 13 percent of the U.S. economy in 1975 to 30 percent of the U.S. economy in 1999. Better and cheaper transportation and communication have been a major force in facilitating this growth. The general forecast is for continued globalization and economic growth in the foreseeable future. Of course, some economic downturns will likely occur over the next 25 years. But future growth will be more dependent on, and will increase the need for, more efficient, more reliable, and safer transportation.

Over the past 25 years, the economy has shifted from heavy industrial production to knowledge-based business, service, and light industry. Despite this relative shift, as well as absolute declines in some sectors, the transportation system anticipates expansion to accommodate transportation of an increasing number of shipments. As a nation, we continue to consume more.

Economic activity is no longer concentrated in a few areas. The traditional manufacturing centers in the Northeast and upper Midwest have suffered a relative decline as new growth occurs in the South, Southwest and Pacific states. This was a particularly significant phenomenon for transportation as the existing transportation infrastructure was planned for an



economy with major industrial centers in the Northeast and Midwest. To the extent that origins and destinations for freight traffic change, corresponding capacity changes in transportation may be needed.

The anticipated increase in foreign trade will require improvements to the capacity and throughput of many ports and to intermodal connectors. Moreover, the growth of foreign sources and destinations of goods as well as increases in e-commerce may result in additional changes to locations of economic activity not well served by the existing transportation system.

### **Changing Population and Development Patterns**

By 2025, according to the U.S. Census Bureau, the nation's population is expected to grow from 274 million in 2000 to 335 million people – a 22 percent increase in only 25 years. The greatest growth would be concentrated in the metropolitan regions of the South and the West. California is projected to hold half again as many people as it does today, as would New Mexico, Hawaii, Arizona, and Nevada. In contrast, Iowa, Ohio, Pennsylvania, and West Virginia, are projected to grow by less than 5 percent. The transportation system may have over-capacity in the older areas of the country and insufficient capacity in the higher growth areas.

Twenty percent of the population will be over 65 years of age. This twenty percent --the 70 million baby boomers who will begin to retire in large numbers by 2011--will be more affluent than any previous generation, and is expected to place greater demands on the transportation system. The sixty percent of the population between 18 and 65 in the year 2025 will be working in an information and service economy that transcends the "9 to 5" work schedule. Many people are expected to be working out of their homes or beginning and ending shifts at staggered intervals. These changes would ease traditional rush hours but would place additional burdens on existing public transit systems and hamper the use of traditional ridesharing.

### **Growth in Passenger and Freight Travel**

The last quarter of the 20<sup>th</sup> century produced growth in most areas of transportation in the United States. By 1997, the US transportation network was supporting 4.6 trillion passenger miles of travel, an 84 percent increase from the 2.5 trillion passenger miles in 1975. Vehicle miles traveled (VMT) and aviation passenger enplanements doubled in the 25 years from 1972 to 1997. This growth is attributed in part to an expanding economy, higher consumer income, greater vehicle availability, reduced travel costs, and increased population. Transit and Amtrak grew more modestly. Transit trips grew from about 7 billion trips a year in 1975 to 9 billion trips at the end of the century, still lower than the 10.5 billion trips a year in 1964 when the predecessor of the Federal Transit Administration was created. Amtrak ridership grew from 17.4 million passengers in 1975 to 21.5 million passengers in 2000.

Freight travel has shown significant gains. In 1997, over \$7.9 trillion worth of freight traveled 3.9 trillion ton miles. This compares with \$1.6 trillion dollars of freight and 2.3 trillion ton miles in 1975. Domestic air cargo shipments trebled. The practice of containerized shipping and surface transportation has improved and increased shipping across the transportation modes.

Many companies increased the efficiency of production, storage, and shipping practices as the economy grew in the late 20<sup>th</sup> Century. The shift from warehousing to “just-in-time” delivery places a significant burden on the reliability of the transportation network. The emergence of e-business also increases the pressure on transportation networks because inventories and consumers are more dispersed.

The freight industry has made great strides in improving intermodal connections, developing more efficient rail/truck/maritime networks and aviation/truck systems to accommodate different shipping needs and provide better service. Initiatives to reduce air traffic delays, reduce paperwork for motor freight carriers, streamline cross-border shipments, track freight by GPS, and other improvements in domestic and international shipping will continue to improve the productivity of the freight transportation network.

All indications are that freight and passenger transportation will continue to grow, requiring more efficient and long-lasting repairs to existing infrastructure, better demand management to improve the efficiency of existing systems, improved safety approaches and techniques and, where appropriate, new transportation infrastructure.

### **New Technologies**

The challenges of growth may be met by new and emerging technologies. In the last decade, computers, telecommunications, and other advances in science and technology have dramatically expanded the range of technologies which mitigate transportation problems such as traffic congestion, air pollution, and safety, in better and cheaper ways.

The world of transportation is slowly merging with the world of communication. The implementation of Intelligent Transportation Systems technologies is improving safety and mobility. This progress depends heavily on communications technology as seen in automated collision avoidance, commercial vehicle sensing, and in-car navigation systems. Rail and highway transportation are achieving greater efficiency through the Global Positioning System (GPS). Ships and planes are applying GPS to supplement or replace older navigational systems.

New materials and technologies are being incorporated in the construction of automobiles. The prototype vehicles developed by the Partnership for New Generation of Vehicles feature lightweight sheathing, innovative hybrid-electric propulsion systems and regenerative braking. Such technologies have made their way to the mass market in commercially available vehicles in Japan and the US.

The emergence of the field of nanotechnology (the building of devices and materials at the level of atoms and molecules) opens a new world of possible technology applications and lighter and stronger materials. For example, nanotechnology could allow for self-healing pavements which would prevent cracks and other road damage.

These are exciting developments, but they are not without potential problems. One troublesome factor is the cost of developing, testing and implementing new equipment and procedures using advanced technologies. Another significant issue is the cost of moving new technology into the

transportation marketplace. New products must be cheaper to produce and provide better service to have a significant effect in the transportation marketplace.

Advances in computer and communications technology -- such as telecommuting and e-commerce -- may mitigate the need for some transportation capacity improvements, as noted above. Telecommuting by individuals may reduce personal travel for commuting but it is not at all clear whether total individual travel will be reduced. Reductions in the number of individual work trips may encourage individuals to move away from their place of work, thus limiting their ability to use public transit or form a car pool. E-commerce internet purchasing may reduce individuals' trips to stores—but such reductions may be offset by a corresponding increase in home package delivery. The net effect of e-commerce on vehicle miles traveled is not yet clear.

These same advances in science and technology have driven change around the world in all aspects of society – accelerating the pace of work, rates of change, and increasing the complexity of business, health and social issues. Whether changes are issue-driven -- as in the need for cleaner and more efficient vehicles -- or technology-driven -- as in the availability of Global Positioning System data for transportation applications—they are having a profound effect on the way transportation looks and operates, the way people use it, and the possibilities for solving current and future problems.

### **Environmental Concerns**

Transportation has a significant impact on the environment. It is a major source for emissions of air pollutants, notably carbon monoxide, volatile organic compounds, and NO<sub>x</sub>. The net effect of aggressive transportation emission regulations has been a dramatic reduction in emissions and measurable improvement in air quality in the nation. Future improvements in air quality will require decisions about how clean citizens want the air to be and how much they are willing to spend to make it cleaner.

The transportation sector accounts for two-thirds of the nation's oil use. Transportation affects water quality, usually in the form of surface water and groundwater contamination through accidental oil spills, pipeline leakage, and leakage of above ground and underground fuel storage tanks. Transportation directly affects water quality through runoff from streets and parking lots and through the improper disposal of used motor oil.

Transportation also contributes to global warming -- the warming of the earth's climate associated with a buildup of greenhouse gases. The atmospheric accumulation of greenhouse gases could have wide-ranging and important effects on global climate systems, some for better, some for worse. Although there is still considerable uncertainty regarding the possible magnitude and distribution of effects, there is little doubt that human activity, including fossil fuel use for transportation, is contributing to increased atmospheric concentrations of greenhouse gases. In the U.S., transportation accounts for about one-third of carbon dioxide emissions, or about 26 percent of total greenhouse gas emissions.

Following the 1992 UN Framework Convention on Climate Change, in 1997 the Kyoto Protocol was adopted by the Convention. Though it has yet to be ratified by the U.S. Senate, the protocol

calls for reductions for the U.S. to reduce GHG emissions by 7 percent compared to 1990 levels in the 2008 to 2012 timeframe. The transportation sector would have a very difficult time meeting its needed reductions as CO<sub>2</sub>, a byproduct of fossil fuel combustion, can only be reduced by burning less fossil fuel, by traveling less or by improving energy efficiency. The Administration's proposed strategy emphasizes improving efficiency and fostering market-based emissions trading.

Air and water quality issues will continue to present challenges for the transportation enterprise over the coming decades. While technology and land use changes may offer some solutions, environmental concerns are likely to affect transportation decisions for the foreseeable future.

### **Energy Prices**

The availability of low cost petroleum for transportation is an important consideration. Petroleum use is ubiquitous in transportation because it is readily available, easily extracted, shipped, and transformed, has excellent combustion properties, and is low cost. When the first *Trends & Choices* report was prepared, energy costs of driving averaged 12 cents a mile in the United States. In the intervening years, the drop in fuel costs coupled with dramatic changes in fuel economy and the way petroleum is used lowered that cost to just over 5 cents a mile. In the first half of the year 2000, gasoline prices spiked, raising concern about the impact higher fuel prices would have on the economy. However, even with pump prices currently over \$2.00 a gallon in some areas, driving costs less per mile than in 1975, about 8 cents a mile.

It is possible that the real price of petroleum will rise over the next 25 years compared with the extremely low prices of the 1990s. Market responses will result in more efficient methods to process petroleum as well as incentives to find alternative raw materials. One challenge before the transportation enterprise is to use the current period of abundance to explore other fuel sources and actions that could be taken to ease any transition to different fuels.

### **Transportation Infrastructure Financing**

Total expenditures for transportation have grown significantly in real terms over the last 25 years. For example, from 1982 to 1994 total transportation expenditures in constant 1987 dollars grew from \$72.2 billion in 1982 to \$97.8 billion in 1994, a 35 percent increase in real terms. Transportation infrastructure expenditures, again in constant 1987 dollars, grew from \$32.4 billion to \$46.7 billion, a real increase of 44 percent.

From 1982 to 1994 states were the greatest source of transportation revenues from user charges, taxes and fees followed by federal and local governments. As a proportion of total transportation revenues, state revenues declined over this period from 55 percent in 1982 to 50 percent in 1994, while federal revenues increased from 23 percent to 29 percent. Local revenues remained relatively constant as a percentage of total transportation revenues.

The results of these expenditures have been significant. The interstate highway system has essentially been completed, numerous transit systems rebuilt and modernized, ports and inland waterways deepened, airport capacity expanded, and rail right-of-way modernized. However,

given the condition of much transportation infrastructure and the likely and desired expansion of the economy, the issue of paying for infrastructure and maintenance improvements is expected to remain a major challenge over the next 25 years as transportation spending competes with other spending needs. Greater reliance on state, local and private funding sources is likely and as well as more prominent use of innovative project financing mechanisms such as loans, loan guarantees and lines of credit. Expansion of federal transportation trust fund mechanisms, new user fees, and the consolidation of transportation trust funds could provide additional funding.

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## CHAPTER FOUR

### DECISION MAKING FOR THE FUTURE

The process for making decisions become increasingly important as the transportation enterprise becomes more complex. Because the transportation enterprise is composed of multiple organizations with multiple goals, no single organization has direct responsibility for the whole or even a majority of the enterprise. This means that strong, effective leadership is necessary at all levels of the transportation enterprise: from federal, state, and local government, from industry partners, transportation operators, and end-users.

Decisions on the complex issues facing the transportation enterprise are circumscribed by a wide variety of existing conditions. They are limited by laws, regulations, policies, and finances; driven by institutional arrangements; focused by financial, cultural and ethical imperatives; and expanded or constrained by available technologies.

Choices available to the transportation enterprise have changed over the last 25 years. Economic deregulation over the past two decades provided increased freedom for the private sector. Similarly, the devolution of many transportation programs from the federal government to lower levels of government and the private sector has changed the context for many decisions. Equally important, globalization has broadened the effects of decisions, and a greater concern for environmental consequences of transportation has precluded some investments that might have been made in earlier times. Also, new technologies allow choices that were either simply not available or infeasible a few years ago.

#### **Framing The Discussion**

To structure discussions about a framework for transportation decision making, a series of questions, including those below, were posed to participants in 2025 Visioning. The questions relate to how the transportation enterprise organizes and manages its work, makes intermodal decisions and establishes effective feedback mechanisms .

- How can the Transportation Enterprise -- comprised of many assets, participants and actions and over which no single member has complete control -- reach and implement decisions that will have the optimal effect on this enterprise?
- How does the transportation enterprise balance individual choices and market forces with broader social goals?
- How does the transportation enterprise, from a national and international perspective, monitor the performance of the system as a whole?
- How should the transportation enterprise make investment decisions?
- How can the transportation enterprise increase its capacity to learn from past decisions and current experiences and identify new opportunities for making informed decisions about the future?
- How does the transportation enterprise foster a climate for transportation innovation?

## **Factors for Effective Transportation Decision Making**

*The Policy Architecture is a very general architecture—it is a declaration of principles.*

*Secretary Rodney Slater, DOT Policy Architecture Forum*

Through legislative and regulatory changes over the years, the transportation enterprise has moved towards a more sound decision making process. This process is more participatory and collaborative, balanced, multimodal, flexible, informed, financially sound, and supported by an effective workforce. These factors, as described below, are the building blocks for an effective policy architecture. Participants in the 2025 Visioning Sessions reminded DOT that the challenge is to continue the evolution towards effective leadership in decision making at all levels of the transportation enterprise to ensure a safe, balanced, reliable, effective, and efficient transportation system. Some of the views of the participants in these meetings are presented along with a brief discussion of the individual ideas they lead to.

*A holistic approach anticipates problems and brings together all of the interested parties to come up with solutions.*

*Larry Susskind, DOT Policy Architecture Forum*

**Participatory and Collaborative.** All stakeholders should have the opportunity to participate in the transportation decision making process. Decision-makers should affirmatively and clearly establish participation in the process.

Transportation decisions should reflect the needs and interests of the diverse population and industry. The goal is to reduce barriers to collaboration across disciplines, institutions, and social structures.

*+Every decision should consider the tradeoffs and interrelationships between and among elements in the system.*

*Session*

*2025 Visioning*

**Balanced.** A transportation decision making process should foster an appropriate balance among individual choices, industry forces and societal goals, and between national goals and regional, local or individual needs.

To be effective, decision making within the transportation enterprise must weigh the tradeoffs among competing interests, views and goals. Decisions that are made without striking an acceptable balance may result in discriminatory policies, ineffectual actions, or objections to implementation. Such outcomes would weaken the process, reduce the confidence of others in the decision makers, and threaten the success of future policy development.

*A package can travel more seamlessly than a person.*

*2025 Visioning Session*

**Multimodal.** The transportation decision making process should focus on multimodal

system-wide aspects of the transportation enterprise rather than any single transportation mode.

While some transportation operations have become steadily more multi-modal, modal-specific organizational structures and funding sources continue to present barriers to a truly multimodal perspective.

*We live in a society with a large number of competing interests.*

*2025 Visioning Session*

**Flexible and Rapid.** The transportation decision making process should be flexible in anticipation of unpredictable and unforeseen events or changes and adaptable to accommodate these events and changes quickly.

It is impossible to anticipate and plan for all future events and changes that could affect transportation. Events, some potentially highly significant, will occur in the future that the transportation decision making process has not anticipated. The transportation decision making process must be flexible to address these changes and adaptable to accommodate them within the decision making structure.

*We have not agreed on the metrics to use to measure the progress of the transportation enterprise.*

*2025 Visioning Session*

**Informed.** A transportation decision making process should be informed by neutral facts, impartial analysis, and expert opinion. Performance measures and enterprise-level planning are needed to assess the effectiveness of the whole transportation system, and evaluate the effectiveness of decisions and investment tradeoffs.

Many historical decisions have been come about because of substantive analyses employed to measure their impact. For future decisions to enjoy a similar grounding, the transportation enterprise should foster credible, professional analysis and unbiased technical information on transportation options using a system-wide perspective. Effective feedback mechanisms are necessary to assess the impacts of choices.

*Habits are hard to change. Only a new habit -- or hitting rock bottom -- will change an old one.*

*2025 Visioning Session*

**Innovative.** The transportation system must be able to respond to the changing world quickly, effectively, and economically.

Innovation in decision making encourages flexibility and responsiveness to change, including the ability to adapt to new and unexpected demands, the creation of an entrepreneurial culture within an organization or decision making body and promotion of a climate for innovation to speed movement of new ideas and products into transportation practice.

*For an option to be viable, it has to be financially feasible.*

*2025 Visioning Session*



**Financially Sound.** The enterprise must make responsible investments and be aggressive and innovative in identifying funding sources.

With potential changes in funding sources as well as increasing demands, adequate financing for transportation --both public and private sector-- may be one of the single most important issues facing the transportation enterprise over the next 25 years.

*Change the way we market transportation careers.*

*2025 Visioning Session*

**Workforce Effectiveness.** The transportation system of the 21<sup>st</sup> century requires workers skilled in a range of disciplines.

At the close of the 20<sup>th</sup> Century, one in every eight jobs in the U.S. was related to transportation. As transportation services and equipment become infused with new technologies and new appreciation of the manner in which transportation serves its many purposes and publics, the requirement for education and training will increase. Appropriate strategies for adequate workforce development include better training at the basic and specialized levels and greater investment in education as well as building a pool of candidates for transportation employment. Aggressive recruitment and broader marketing of transportation careers will be required to attract people to keep the system operating effectively and readily able to meet its challenges.

## **CHAPTER FIVE**

### **STRATEGIES TO SUPPORT A CHANGING ENTERPRISE**

The transportation enterprise can choose from a variety of strategies to move towards a more effective decision making process. The Department's Vision 2025 sessions engaged a wide variety of stakeholders in the transportation enterprise concerning their vision of the future and strategies for supporting the enterprise in that future. The responses covered a wide variety of policy options--some involved radical change while some are more incremental. The strategies outlined below synthesize the suggestions received and present a menu of choices.

#### **Strategies to Foster Participation and Collaboration**

Transportation decisions should reflect the needs and interests of diverse populations and industries. Since the enactment of ISTEA and TEA-21, surface transportation public investment decisions require a comprehensive plan that reflects public participation. The federal government recently strengthened participatory processes by expanding the concept of environmental justice so all segments of society may receive the benefits of transportation and no one segment of society bears the adverse impacts of transportation disproportionately. Information sharing is crucial to maximizing participation and ensuring that new entities and organizations can understand the decision making process and how to influence it. For any given decision, accountability and participation in the process require identification of the problem to be addressed, specific procedures to be followed, those who will make the final decision, and all stakeholders in the outcome. For transportation to continue to contribute to economic prosperity and social cohesion, the process should not hinder desired change, but should encompass a full airing of all the views and careful consideration of the full impact of decisions. Suggested strategies for public participation and collaboration include:

- Expand the decision making process to include all stakeholders
- Develop and use techniques for consensus building and conflict resolution.
- Improve information sharing and coordination among state, local and federal transportation agencies and the private sector.
- Use new communications technology to increase the information available, facilitate collaboration and improve participation.
- Expand the use of public/private partnerships to further collaborative approaches.
- Develop and use an open process with clearly established procedures to be followed, enumeration of the decision to be made, and identification of the decision-maker(s).

#### **Strategies To Foster A Balanced Approach**

Transportation decision making process should have the ability to balance competing needs and thereby create "win-win" solutions. The needs and concerns of all individuals and groups must be taken into account. The federal government fosters national goals while recognizing that states and localities can better address regional and local goals. Local decision makers face balancing the transportation needs of individuals and neighborhoods with the development goals

of the whole community. As one example, Vision 2025 participants expressed concern that the transportation enterprise was not fully incorporating the concept of sustainability—to meet the needs of the present while not compromising the ability of future generations to meet their needs. In the future, the U.S. will increasingly face choices in responding to global concerns. A balanced approach should:

- Accelerate the integration of transportation planning with commercial concerns (economic and residential development, trade, etc.), with environmental concerns (air, water, noise, light, land use, species, sustainability, etc.), and with health care and social concerns (pollution, safety, access, mobility, environmental justice, etc.).
- Apply a multi-disciplinary approach to state and local policy, planning and implementation.
- Integrate sustainability with economic development and mobility evaluations.
- Develop improved techniques to address environmental justice issues.
- Improve global transportation connections and related supporting U.S. transportation improvements.

### **Strategies To Foster Multimodalism**

Market demand increasingly calls for a multimodal approach and more effective intermodal connections to ensure seamless services. The technology and organization of freight transportation, in particular, has encouraged shippers and carriers to consider transportation from an intermodal perspective, but in the public sector most transportation actions are still taken on a mode by mode basis. The integration of information systems into the heart of the freight industry, rather than the traditional transport functions dominating the industry's structure and processes, has transformed a fragmented industry into a powerful and efficient enterprise. The freight industry sets a powerful example for passenger modes to consider in meeting the total service needs of their clientele rather than segmented transport services.

Public sector transportation organizations face a unique challenge in adapting their organizational structures due to the large number of stakeholders with vested interests in different components of the organizations. As a result, some public sector transportation organizations are behind the private sector in organizing in an integrated way. Many state DOTs are organized primarily to build highways and do not adequately support other transportation mode choices. The U.S. Department of Transportation structure does not reflect the multimodal manner in which transportation services occur. In the absence of significant organizational restructuring, the ONE DOT approach seeks to promote solutions that transcend the existing modal approach. Vision 2025 participants called upon the enterprise to recognize that all member decisions take effect in a multimodal market environment. They also emphasized the need for strategies that encourage a more unified, comprehensive consideration of transportation issues. Multimodal strategies include:

- Implement multimodal organizational structures for U.S. and state DOTs and open specialized modal agencies such as airports, toll authorities to explicit cooperation and collaboration.
- Establish a transportation enterprise planning process.

- Implement common multimodal procedures for transportation project evaluation.
- Work to reach consensus on performance measures and standards.
- Remove barriers to the formation and operation of multimodal private transportation companies.
- Replace single mode advisory committees with multimodal committees where appropriate and consider establishing a standing committee to address multimodal issues.
- Collect and use transportation data on a multimodal and market basis.

### **Strategies To Support More Flexible and Rapid Decision Making**

Changing issues and the participation of diverse stakeholders will require a decision making process that is more flexible and able to adapt to these changes. At the same time, economic globalization, growth and technological innovation will require more rapid decision making. Minimizing rigid rules and procedures and acceptance of new approaches will be essential to foster a more flexible and rapid decision making process. Strategies to advance the flexibility and pace of decision making include:

- Streamline regulations and procedures to speed up decisions and simplify processes.
- Change decision making processes to include considerations of uncertainty and risk.
- Undertake pilot programs to demonstrate new approaches to decision making.
- Foster a climate of urgency, flexibility and experimentation;

### **Strategies To Support Informed Decisionmaking**

An informed decision making process requires that participants have access to sound information about the issues at stake. 2025 participants also emphasized the importance of periodically assessing the impact of transportation decisions.

- Identify emerging issues and analyze the impact of policy options on users and other groups affected by system changes.
- Integrate scientific and technical analysis in policy dialogues.
- Collect reliable and comprehensive multimodal transportation data.
- Forecast trends.
- Establish standard measures for evaluating the transportation enterprise.
- Analyze the performance of the national transportation system.
- Evaluate the results of implementation of policy options.
- Foster the establishment of effective feedback mechanisms across the transportation enterprise including customer preferences and behavioral responses.

### **Strategies To Foster Innovation**

Investing in a climate of innovation ensures that innovative ideas are explored, researched, developed or deployed where they are more effective than existing approaches. Encouraging regions to experiment with different transportation processes allows enterprise members to learn from multiple experiments and select approaches that work best. Technology can increase the

flexibility of both new and existing investments, helping the system operate more efficiently and serving more people in a safer, cleaner, faster, and more accessible way. Government members use collaborative strategic planning to identify national and transportation-specific needs for research and development, provide policy direction and establish administrative-level program management, and cost-sharing. Industry members, in addition to providing views on areas of need, compete for contracts, lead the research and development, and produce and market the results. This public/private partnership approach produces market viable results at a reduced cost. Strategies to maximize returns on technology investments included:

- Establish aggressive goals that challenge the enterprise to find new technological solutions.
- Conduct R&D on strategic goals on a collaborative basis.
- Establish pilot programs to test transportation strategies in limited geographic areas that have potential transferability to national policy.
- Provide regulatory waivers to allow testing of innovative ideas.
- Increase and diversify research and development financing sources.
- Support research and development of new technologies in the private sector.

### **Strategies To Foster Sound Financing**

To meet future investment needs, the enterprise should examine existing and potential funding sources that are adequate, reliable, and equitable. While only the expected value of return limits the private resources available for investments, prevailing political and economic conditions constrain public investments. For the private sector, some members of the transportation enterprise have expressed concern about their ability to compete with other investment choices. Trust funds, supported by fuel taxes, fund most federal and state transportation programs. Trust funds are relatively equitable and dependable. The flexibility to use trust funds for different modes of transportation has expanded. However, dramatic improvements in fuel economy and development of non-fossil fuel energy sources could limit the future revenues from fuel taxes. User fees can help finance many services, but public perception of transportation as a “free” good, as well as national concerns about equitable mobility, limit the expansion of such fees. Strategies for meeting the financing needs include:

- Expand flexibility in uses for trust fund revenues across transportation modes.
- Establish a unified trust fund for public sector transportation investments.
- Allow states to experiment with unified transportation funding.
- Expand innovative financing mechanisms such as TIFIA and RRIF for blending private and public capital money.
- Charter selected public functions and agencies as performance-based organizations financed by discrete user fees.
- Remove legislative and regulatory barriers that limit transportation agencies from pursuing entrepreneurial approaches in generating revenues from their operations.
- Continue to encourage the privatization of government transportation activities that would be operated better by the private sector.

With much of the nation's transportation infrastructure largely completed, attention is focused on preserving, maintaining, and increasing the efficiency of that investment. In the coming years, the majority of funds spent on the transportation system will be spent on this asset management function. Moreover, as construction of new infrastructure becomes more expensive and environmentally questionable, the transportation enterprise may be required to focus more attention on demand management, making the most effective use of existing infrastructure. Strategies for investment decisions should:

- Foster new organizational arrangements and approaches to asset management.
- Assure adequate funding for system preservation.
- Increase use of transportation alternatives such as public transportation, larger planes, intercity rail, and communications including telecommuting and teleshopping.
- Deploy congestion pricing techniques.
- Modify evaluation procedures to adequately reflect the benefits of system preservation and sustainable transportation options such as demand management.

### **Strategies To Foster An Effective Workforce**

As the enterprise members expand beyond engineering into managing and monitoring the system's operations, they require workers with backgrounds in operations, systems engineering, traffic engineering, economics, political science, finance, psychology, and other areas. Fewer members of the modern transportation enterprise expect lifetime employment with a single employer or even within a single occupation. Participants in the Vision 2025 sessions consistently cited workforce development as a major strategy for supporting ongoing changes among enterprise members. Strategies include:

- Continue to examine the changing needs of a workforce needed to design, maintain and operate a 21<sup>st</sup> century transportation system.
- Identify the long-term workforce needs including numbers of people needed and the necessary skill mix.
- Adapt programs and jobs to attract new staff to transportation jobs and to reflect changes in the workforce population.
- Support and assist college and university programs to develop the next generation of transportation professionals.
- Establish and enhance programs for continuous education and training, including a focus on new technologies, for transportation workers.

## **CHAPTER SIX**

### **STRATEGIES FOR THE U.S. DEPARTMENT OF TRANSPORTATION**

In its role as steward of the nation's transportation system, the U.S. Department of Transportation will exercise leadership in addressing the emerging challenges of the coming years. DOT recognizes that the federal government alone, and in fact the public sector alone, cannot ensure that the transportation enterprise will be ready. All participants in the enterprise are partners in this endeavor. DOT will play a critical role in setting the direction for the transportation enterprise. DOT must be vigilant and visionary in determining that the transportation enterprise is accomplishing its strategic goals of safety, mobility, economic growth, human and natural environment, and national security.

Given the complexity of decision making in the transportation sector, DOT plays a key role as a leader, facilitator, information provider, educator, mediator and impartial convener, even when DOT is not the principal decision-maker. In this "trusted leadership" role, the Department can contribute to the vitality of decisions made by others particularly by providing information that informs national, regional and local decision makers.

As a part of its stewardship responsibilities, DOT will continue to make those decisions for which it is responsible. DOT is committed to ensure that its own decision making processes are instituted and operate in a way that further improve decision making.

Stewardship is also accomplished through national strategic planning, by setting stretch goals and by doing some of the long-term/high risk research identified by the transportation enterprise.

To lead the policy architecture process for the future, DOT could implement the following strategies:

- Sponsor national and international dialogues on major, cross-cutting issues to define issues and foster discussion on the long-term future of transportation.
- Produce "green papers" that discuss emerging issues in an objective, impartial manner that does not prejudge what a response should be.
- Disseminate "white papers" describing proposed policies and programs as issues are considered and evaluated in the decision making process.
- Maintain and disseminate high quality transportation data.
- Establish a legislative mandate for transportation enterprise planning that requires:
  - Preparing periodic "State of Transportation" Reports.
  - Conducting enterprise planning to evaluate the system-level performance of the transportation enterprise and to identify emerging issues and concerns.
  - Sponsoring biennial conferences on the Future of the Transportation Enterprise.

## CHAPTER 7

### CONCLUSION

To meet future challenges, the transportation enterprise is moving towards an increasingly flexible, multi-modal association of organizations that invests in the creation and operation of locally and globally responsive systems. The Department of Transportation and other members of the transportation enterprise have begun to change the way they do business. It is clear that the way decisions have been made in the past will not suffice for the future. Transportation decision making structures will evolve to allow the transportation enterprise to face the challenges of the future.

***Strong leadership will be required in managing change and creating a transportation vision to meet the transportation challenges for the future.***

The principal focus of the transportation enterprise for the next twenty five years is ensuring that the nation's transportation system serves our citizens and supports national outcomes of continued economic growth, enhanced international competitiveness, stronger democratic processes and a secure nation.

***In conjunction with strong leadership, a new decision making framework, focusing on transportation decision making factors and strategies to move towards more effective and responsive decisions.***

The factors for an effective policy architecture are participatory and collaborative, balanced, multimodal, flexible, informed, innovative, financially sound, and supported by an effective workforce. The challenge is to continue the evolution towards effective decision making at all levels of the transportation enterprise that results in a more efficient and effective transportation system and supports a system that promotes safety, improves mobility, advances economic growth and trade, enhances the environment, and advances national security.

***The stewardship role of the Department of Transportation can foster improved decision making across the transportation enterprise.***

The U.S. Department of Transportation plays a key role in the transportation enterprise's decision making process. Over the past 12 years, the Department has taken steps to move towards a transportation system that is:

- Intermodal in form;
- Inclusive in nature;
- International in scope,
- Intelligent in character; and
- Innovative in approach

The U.S. Department of Transportation will be called upon to provide the leadership to meet the challenges of tomorrow. As the decision making environment for transportation continues to



decentralize, the U.S. DOT's *trusted leadership* role becomes one of vision setter, facilitator and impartial convener, as well as, providing funding, technical support, and operational guidance..

This report is intended to energize the participants in the transportation enterprise to focus on crucial questions and provide a framework for addressing transportation decision making over the next twenty five years of change.

By focusing on how decision making needs to change and by making the necessary adjustments, the transportation enterprise can rise to the challenge proffered by Secretary John A. Volpe and be architects – not victims -- of change.

## **ACCOMPLISHMENT BOXES**

(This is not a separate chapter. These descriptions will be placed in boxes throughout the report to highlight DOT's accomplishments in improving decision making)

## **ISTEA/TEA-21**

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) authorized \$151 billion over six years for highways, mass transit and safety programs. In a major breakthrough, the Act created a surface transportation program with flexible funding that opened the door to new opportunities to address statewide and urban transportation problems.

The Transportation Equity Act for the 21st Century (TEA-21), signed into law on June 9, 1998 by President Clinton, built and expanded upon ISTEA policies and programs. TEA-21 guaranteed a record \$198 billion in surface transportation investment for highways, highway safety, transit and other surface transportation programs from FY 1998 through FY 2003. It continued all the major ISTEA programs, and added a number of new programs to meet specific safety, economic, environmental and community challenges.

Although TEA-21 retains the basic structure established by ISTEA, it does include some important changes. Two of the most significant achievements of TEA-21 are: the guaranteed funding and the continuation and expansion of the landmark environmental programs created by ISTEA. TEA-21 also strengthens the planning requirements, expands the flexible funding provisions, and places a stronger emphasis on safety. It included some new programs, such as funding for border crossing and trade corridor activities, to meet specific challenges. It continues special provisions for hiring women and minorities, the Disadvantaged Business Enterprise requirement, and labor protections such as the Davis-Bacon prevailing wage guarantee.

## **Marine Transportation System**

Today, over 95 percent of goods, by tonnage, entering the U.S. come through our ports and waterways. The total volume of domestic and international marine trade is expected to more than double the next 30 years. Positive steps are needed to ensure that the marine transportation system is able to handle these emerging needs and contribute to the security and economic vitality of the nation.

The Coast Guard Authorization Act of 1998 required the Secretary of Transportation to prepare a report on the status of the marine transportation system and recommendations for improvement. Under Secretary Slater's leadership, DOT developed a bold and comprehensive plan to modernize our nation's Marine Transportation System (MTS). The MTS Task Force convened almost a hundred federal, state, local and private sector participants in the marine transportation sector to develop a vision for the future, the issues facing the industry, and a course of action. The goal and vision for this system is to be the world's most technologically advanced, safe, secure, efficient, globally competitive, and environmentally responsible system for moving people and goods by 2020.

The MTS Task Force extended the ONE DOT commitment of the Secretary and recommended an interagency committee of all the federal agencies with marine transportation responsibilities, and a Marine Transportation System National Advisory Council to address the different viewpoints of all the stakeholders and to make recommendations for action. The Secretary has followed through on these recommendations and established these councils. Officials from the

Departments of Defense, Commerce, Treasury, Agriculture, Interior and the Environmental Protection Agency joined Slater in signing the Memorandum of Understanding (MOU), which creates the Interagency Committee for the MTS (ICMTS). This committee is charged with improving the federal government's coordination of MTS-related programs and ensuring that maritime policies, strategies and goals are consistent with national needs.

### **Open Skies**

The Open Skies Initiative gives airlines maximum flexibility in structuring their international services in response to market demands. Under Secretary Slater's leadership, the U.S. has opened more markets and created more opportunities for international air service than in any comparable period, while providing passengers and shippers more frequent service and lower fares. Secretary Slater's historic Chicago conference, entitled, "Aviation in the 21<sup>st</sup> Century - Beyond Open Skies Ministerial Conference," made tremendous progress for these markets.

The U.S. signed six new "Open-Skies" agreements with Italy, Pakistan, the United Arab Emirates, Bahrain, Tanzania, and Argentina. The initialing in August 1999 of the long-sought Open-Skies agreement with Argentina brought the total number to 38. DOT achieved Open-Skies agreements in nearly every part of the world: Six in the Asia/Pacific area, 14 in Europe, 5 in the Near East/Central Asia, and 11 in this Hemisphere.

The alliances have led to a more efficient global transport market that provides better, more cost effective service to consumers. Open Skies agreements allow airlines to determine which markets to serve, which aircraft to use, how many flights to operate, and what prices to charge.

### **Transportation Infrastructure Finance and Innovation Act**

The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) provides Federal credit assistance to major transportation investments of critical national and regional importance. TIFIA, authorized under the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21), provides direct loans, loan guarantees, and lines of credit, instead of grants, to private and public sponsors of major surface transportation projects. The program is designed to fill market gaps and leverage private co-investment by providing supplemental and subordinate capital.

A total of \$530 million in Federal funding was authorized to pay the "subsidy cost" of supporting Federal credit under TIFIA. Annual caps totaling \$10.6 billion limit the principal amount of credit instruments issued. Any project that is eligible for Federal assistance through existing surface transportation programs (highway projects and transit capital projects) is eligible for the TIFIA credit program. Intercity passenger bus and rail facilities and vehicles, publicly owned intermodal freight facilities, border crossing infrastructure, and highway trade corridors are also eligible.

The first round of TIFIA projects in FY 1999 provided \$1.6 billion of credit assistance to projects in California, the District of Columbia, Florida, New York, and Puerto Rico to support \$6.5 billion in transportation projects. The cost to the federal government was only \$61 million.

TIFIA continues to advance the state of innovative financing for transportation investment. Begun with flexible grants and the Grant Anticipation Revenue Vehicle or GARVEE bonds, these innovative programs have helped finance nearly 200 projects worth more than \$13 billion. For example, the Department's credit support for the \$2.4 billion Alameda Corridor project in California helped lay the groundwork for TIFIA. By providing a \$400 million loan, DOT is a

minority-share investor in this 20-mile rail express line that will connect the nation's largest port complex at San Pedro Bay to the transcontinental rail network near downtown Los Angeles.

## **Safety**

Highway related fatalities stood at 41,471 in 1998. Secretary Slater has announced a goal of reducing fatalities to 33,000 by 2008, and an interim goal below 40,000 by the end of 2002. To achieve this goal, a ONE-DOT Task Force has been formed, with membership from the modal administrations. This group will develop a coordinated package of requests for the Department's FY 2002 budget submission, which will consist of a set of complementary programs and initiatives designed to ensure that the goal is reached.

On December 10, 1999, President Clinton signed the Motor Carrier Safety Improvement Act of 1999, which created the Federal Motor Carrier Safety Administration on January 1, 2000. This new law will get dangerous vehicles off of our highways, save additional lives and help reach the goal of reducing motor carrier-related fatalities by over 50 percent by 2010.

Through the Department's efforts nationwide, seat belt use nationally rose to almost 70 percent in 1998, the highest belt usage rate on record in the U.S. Each year, seat belts are estimated to save more than 10,000 lives. Through the use of innovative Public Service Announcements, the Department has increased usage in high-risk populations such as African-Americans and Native Americans.

## **AIR-21**

Wendell H. Ford Aviation Investment and Reform Act for the 21st Century also known as the Aviation Investment and Reform Act for the 21<sup>st</sup> Century (commonly known as AIR-21) was enacted by Congress and signed by the President this spring. The act substantially increases the funds for airport development both through the Airport Improvement Program and enabling an increase in the Passenger Facility Charge. Congress also authorized funds for the continued redevelopment of the air traffic control infrastructure that is undergoing the most significant change in technology and procedures in fifty years

AIR-21 provides needed airport infrastructure grants that can result in competitive access for new entrant carriers across the nation. A fundamental premise of the Administration from the beginning has been to provide the modern infrastructure needed in all modes of transportation to allow economic growth free rein.

AIR-21 represents a sound first step toward our long-term objectives for modernization

and stability of the FAA's critical air traffic services for the nation. Fundamental, structural improvement of the air traffic control system is needed now to handle the expanding airline traffic generated by our vibrant economy. It will focus the FAA's future in the direction of business-like practices.

The aviation consumer would benefit as well. Increased authorizations are contained in the bill to provide for Department enforcement of consumer protection provisions under many regulatory provisions, such as those prohibiting deceptive advertising and those providing denied boarding protection.

### **Intelligent Transportation Systems**

The Intelligent Transportation System (ITS) program was established by ISTEA in 1991. ITS represent a next step in the evolution of the nation's entire transportation system by applying new technologies from computers, electronics, and communications to surface transportation systems. ITS can be applied to our vast transportation infrastructure of highways, streets, and bridges, as well as to a growing number of vehicles, including cars, buses, trucks, and trains. These information and communications technologies can also be used to better manage and improve how transportation providers such as governments, transit agencies and truckers offer services to the public.

Former DOT Secretary Federico Peña announced a national goal of implementing ITS in all the major metropolitan areas by the year 2005. Under the leadership of Secretary Slater, there has been major progress in achieving that goal. Indeed, TEA-21 has shifted the focus of the Federal ITS program from primarily research and operational tests to a balanced program of research and deployment support.

### **Project America**

On July 1, Ingalls Shipbuilding cut the first piece of steel that will eventually become the largest cruise ship ever built in this country, and the first one in more than forty years. Project America, as it is known, is the result of a number of "first-ers" including the largest, and most complex transaction ever completed by the Maritime Administration (MARAD). In addition to being a tremendous challenge to Ingalls Shipbuilding, to return America to large cruise vessel construction, Project America involves more than \$1 Billion in Title XI loan guarantees, eclipsing by almost a factor of five our previous largest project. In order to complete this, in a prescribed time period, MARAD had to create new financial analyses skills, structures, but most importantly develop close relationships (partnerships) with Ingalls shipbuilding and the applicant; relationships founded on honesty, trust and a genuine business basis.

### **Garrett A. Morgan Technology and Transportation Futures Program**

Garrett Morgan (1877-1963) was an African-American inventor whose lifetime of contributions include the invention of the traffic signal. This technology has been electrified, then computerized, but not replaced because the science of its use was both revolutionary and ahead of its time.

The Garrett A. Morgan Technology and Transportation Futures Program serves as a catalyst to enhance transportation education at all levels by leveraging the Department's current technology, education, and research programs; and forging public/private partnerships.

The Garrett A. Morgan Technology and Transportation Futures Program has three goals:

- To build a bridge between America's youth and the transportation community;
- To support the development of improved educational technology that provides better ways for people to acquire new skills; and
- To ensure that America's transportation work force for the 21<sup>st</sup> century is technologically literate and internationally competitive.

By 2000, the Morgan Program will have reached 1 million students.

## **TRANSPORTATION TECHNOLOGY BOXES**

(This is not a separate chapter. These descriptions will be placed in boxes throughout the report to highlight promising new technologies that are likely to affect transportation in the future.)



## **Information Technologies in Future Transportation**

The next 25 years hold great promise for the evolution of information and wireless technologies in future transportation. As researchers improve the intelligence capabilities of computers – particularly the ability to imitate the human process of reasoning – they will become an integral support in safety-related decision processes involved in transportation. Decisions that include large numbers of factors involving natural and human processes, such as those of drivers of motor vehicles, will benefit from this capability. Drivers will carry wireless devices with sensors that will “read” their surroundings – traffic congestion, road conditions, air quality, weather, and compass direction – as well as the driver’s own vital signs. A tiny transmitter will continuously relay the data back to a command post for analysis by large computers as part of an ongoing, real-time decision making process of urban transportation. As a result, drivers will have many more options available at an earlier stage, improving their chances of avoiding accidents.

## **Improving Transportation Efficiency With GPS**

Public and private organizations rely on GPS and other technologies to improve transportation safety and efficiency. The cascade of benefits includes millions of dollars in savings throughout the economy, enhanced customer satisfaction, and improved air quality. For example, each of Denver’s 800 buses is equipped with a GPS-based automatic vehicle location system that reports the location of the bus every two minutes. Dispatchers have improved their ability to keep buses running on time by viewing bus locations on computer screens that are fully integrated with digital city maps. The system is credited with increasing use of the bus system, relieving traffic congestion, and reducing smog.

GPS tracking technology at the American President Line’s Global Gateway South at the Port of Los Angeles automatically matches a cargo container’s identification number with its location in the yard. Back at the terminal, a computer stores the GPS location and content data for each container. Using on-board navigation, drivers can now negotiate the 6,000-space holding tank and drive straight to the proper container the first time, eliminating costly mistakes and saving time and money. The system increases the overall efficiency of the cargo storage space, an important benefit for port facilities with no room for expansion.

## **Partnerships for a Cleaner Environment**

Partnerships among government, industry, and educational institutions can generate new technologies that will grow our economy and help our environment at the same time. The Federal government has taken a leadership role in initiating partnerships designed to fulfill all of these objectives.

In the Partnership for a New Generation of Vehicles (PNGV), different sectors are combining forces to unlock new technologies that will develop a new class of vehicles with a fuel efficiency of up to 80 miles per gallon and maintain performance, safety, and cost comparable to today’s cars. PNGV joins seven Federal agencies and 19 Federal laboratories with the U.S. Council for Automotive Research (USCAR), which represents Daimler-Chrysler, Ford, and General Motors. The PNGV partnership ultimately will help create new jobs, improve global competitiveness,

reduce U.S. dependence on foreign oil, and decrease greenhouse gas emissions.

Researchers expect the next 25 years to bring strong new growth in development of alternative fuels and other renewable energy technologies for transportation that are friendlier to the environment. Over the longer term, these new fuel sources will be economically competitive with current fossil-fuel technologies. Developing countries around the world are expected to play a particularly prominent role in the rise of alternative fuel and renewable energy technologies for transportation. As developing countries create their transport infrastructure between now and 2050, investments in new fuel and energy technologies are projected to reach a level between \$15 trillion and \$25 trillion. This dynamic new global market for new fuel and energy technologies will likely stimulate new partnerships for American businesses, if they are ready with the technologies that emerging economies demand. This market also presents a remarkable opportunity for America's transportation enterprise to create these new technologies that will allow us to continue improving the quality of human life while reducing our dependence on fossil fuels and their associated environmental dangers.

### **E-Commerce and Transportation**

The Internet's rapid growth will become a significant economic force, offering new avenues for consumer and business-to-business transactions of goods, information, and funds. The Internet economy generated revenues totaling an estimated \$301 billion in 1998. Retail sales on the Internet are also climbing rapidly. Private analysts forecast that the value of Internet retailing could reach between \$40 billion and \$80 billion by 2002. Direct, business-to-business commerce on the Internet is forecast to surpass \$1.3 trillion per year by 2002. Future package delivery industries will establish that the flow of information about packages and movement of funds – enabled by technology, logistics knowledge, and the Internet – is nearly as important as moving the packages themselves.

### **Virtual Manufacturing of Future Air Transports**

Designing, testing, and manufacturing future aircraft requires many human and material resources. Information technologies help integrate computer design tools with models and simulations of manufacturing processes for more efficient design, analysis, and testing of products. These virtual tools greatly reduce the investment required for product prototyping, testing, and validation. The story of the development and production of the Boeing 777 is a vivid illustration of the adoption of virtual manufacturing and the efficiencies that technology can create.

The latest relative in Boeing's family of jetliners, the 777 is the first airplane to be completely designed and pre-assembled virtually – that is, by computer. Performance and strength of the plane were analyzed and tested through complex computer models. Of its three million parts, more than 100,000 are unique; they were precision-engineered from computer models. The parts were manufactured separately at sites spread around the world, then shipped to a central plant, where they were assembled. They fit together perfectly on the first attempt. The cost savings to Boeing were tremendous, and the company won multiple manufacturing and innovation awards.

## **Microengineering Powers**

Within the past 5 years at MIT, a careful scaling study of high-speed, rotating turbomachinery has shown that suitably designed microdevices are actually remarkably promising for future power generation and air transport applications.

A conventional-sized aircraft engine consists of a compressor, a combustion chamber, and a turbine that is driven by the combustion exhaust and powers the compressor. The residual energy in the engine's exhaust stream provides the thrust. According to MIT's Gas Turbine Laboratory Director, Alan H. Epstein, "a large-scale aircraft engine with a one-meter-diameter air in-take generates power on the order of 100 megawatts. When such a device is scaled to millimeter size, tens of watts potentially could be produced" ... and that "a millimeter size engine would have a thrust-to-weight ratio of about 100:1, compared to 10:1 for the best modern aircraft engines." This level of performance may have profound implications for next generation flight and space vehicles.

Microfabricated microelectronic materials have few defects and are thus quite strong. Thus, compared to the metal alloys used in today's full-scale engines, microengine materials can operate at high rotation speeds without the risk of destruction. In addition, the chemical process of burning the fuel and air inside the combustion chamber is extremely important to the fuel efficiency and clean emissions of aircraft engines. A 2-millimeter-long combustion chamber suitable for microengine use has been recently demonstrated by researchers at MIT.

## **Nanotechnology Affects Transportation**

Today's research provides a glimpse of the future in manufacturing, construction, and computing in transportation. Scientists are now able to see things at the molecular level, and are rapidly gaining the ability to manipulate materials and processes at the nano-level. (A nanometer is one-billionth of a meter, tens of thousands of times smaller than the width of a human hair.) In the emerging field of nanotechnology, researchers are working to find ways to change the very composition of materials to emphasize desired characteristics such as strength and flexibility. Nanotechnology holds tremendous promise for future manufacturing and construction of transport infrastructure, signaling a new ability to custom-design materials that transportation engineers might need for innovative designs. Nano-engineers are already envisioning "self-assembling" devices that will rebuild copies of themselves, molecule by molecule, following programmed instructions. Transportation researchers can even expect to see molecular-size switches for computer circuits used in transport systems – from urban mass transit to air traffic control. In the next 25 years, nanofabrication processes will move from the laboratory to the assembly line, and new nano-materials and molecular computers will find countless new applications in products and processes that will achieve even greater efficiencies and quality levels.